

Appendix M

Analysis of Environmental Justice

M.1 INTRODUCTION

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse health or environmental effects of their programs, policies, and activities on minority and low-income populations.

The Council on Environmental Quality has oversight responsibility for compliance with the National Environmental Policy Act (NEPA). In December 1997, the Council released guidance on environmental justice (CEQ 1997). The Council's guidance was adopted as the basis for the analysis of environmental justice contained in the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS).

M.2 DEFINITIONS AND APPROACH

The following definitions were used in the analysis of environmental justice (CEQ 1997):

- Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the U.S. Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.
- Minority: Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.
- Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In identifying minority communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or American Indians), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected minority population. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds.
- Disproportionately high and adverse human health effects: When determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practical:
 - a. Whether the health effects, which may be measured in risks and rate, are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death; and

- b. Whether the risk or rate of hazard exposure by a minority population or low-income population to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and
 - c. Whether health effects occur in a minority or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.
- Disproportionately high and adverse environmental effects: When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practical:
 - a. Whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority or low-income population. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities or low-income communities, when those impacts are interrelated to impacts on the natural or physical environment; and
 - b. Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations or low-income populations that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and
 - c. Whether the environmental effects occur or would occur in a minority population or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

Data for the analysis of minorities were extracted from Table P12 of Summary Tape File 3A published on CD ROM by the United States Bureau of the Census (DOC 1992). Data for the analysis of low-income populations were extracted from Table P121 of Standard Tape File 3A.

Potentially affected areas examined in the SPD EIS include the areas surrounding proposed reactor sites for mixed oxide (MOX) fuel irradiation: Catawba Nuclear Station, McGuire Nuclear Station, and North Anna Power Station.

M.3 SPATIAL RESOLUTION

For the purposes of enumeration and analysis, the Census Bureau has defined a variety of areal units (DOC 1992). Areal units of concern in this document include (in order of increasing spatial resolution): States, counties, census tracts, block groups, and blocks. The “block” is generally the smallest of these entities and offers the finest spatial resolution. This term refers to a relatively small geographical area bounded on all sides by visible features such as streets and streams, or by invisible boundaries such as city limits or property lines. During the 1990 census, the Census Bureau subdivided the United States and its territories into 7,017,425 blocks. For comparison, the numbers of counties, census tracts, and block groups used in the 1990 census were 3,248; 62,276; and 229,192; respectively. While blocks offer the finest spatial resolution, economic data required for identification of low-income populations are not available at the block-level of spatial resolution. In the analysis below, block groups are used throughout as the areal unit. Block groups generally contain between 250 and 500 housing units (DOC 1992).

During the decennial census, the Census Bureau collects data from individuals and then aggregates the data according to residence in geographical areas such as counties or block groups. Boundaries of the areal units are selected to coincide with geographical features, such as streams and roads, or political boundaries, such as

county and city borders. Boundaries used for aggregation of the census data usually do not coincide with boundaries used in the calculation of health effects. Radiological health effects due to an accident at one of the reactor sites for MOX fuel irradiation are evaluated for persons residing within a distance of 80 km (50 mi) of the accident site. In general, the boundary of the circle with an 80-km (50-mi) radius centered at the accident site will not coincide with boundaries used by the Census Bureau for enumeration of the population in the potentially affected area. Some block groups lie completely inside or outside of the area included in the calculation of health effects. However, block groups intersecting the boundary of the potentially affected area are only partly included. Because the geographical distribution of persons residing within a block group is not available from the census data, partial inclusions introduce uncertainties into the estimate of the population at risk.

In order to evaluate populations at risk in partially included block groups, it was assumed that residents are uniformly distributed throughout the area of each block group. For example, if 85 percent of the area of a block group lies within 80 km (50 mi) of the accident site, then it was assumed that 85 percent of the population residing in that block group would be at risk. An upper bound for the population at risk was obtained by including the total population of partially included block groups in the population at risk. Similarly, a lower bound for the population at risk was obtained by excluding the population of partially included blocks from the population at risk. As a general rule, if the areas of geographic units defined by the Census Bureau are small in comparison with the potentially affected area, then the uncertainties due to partial inclusions will be relatively small. Uncertainties in the estimates of populations surrounding reactor sites for MOX fuel irradiation are described in M.5.1 below.

M.4 POPULATION PROJECTIONS

Health effects were calculated for populations projected to reside in potentially affected areas during the year 2015. Extrapolations of the total population for individual States are available from both the Census Bureau and various State agencies (Campbell 1996). The Census Bureau also projects populations by ethnic and racial classification in 1-year intervals for the years from 1995 to 2025. Data used to project minority populations in the SPD EIS were extracted from the Census Bureau's Web site at www.census.gov/population/www/projections/stproj.html. Minority populations determined from the 1990 census data were taken as a baseline. Then it was assumed that percentage changes in the minority and majority populations of each block group for a given year (compared with the 1990 baseline data) will be the same as percentage changes in the State minority and majority populations projected for the same year. An advantage to this assumption is that the projected populations are obtained with consistent methodology regardless of the State and associated block group involved in the calculation. A disadvantage is that the methodology is insensitive to localized demographic changes that could alter the projection for a specific area.

M.5 RESULTS FOR THE REACTOR SITES

M.5.1 Minority and Low-Income Population Estimates

Table M-1 shows total populations, minority populations, and percentage minority populations that resided within 80 km (50 mi) of the various sites at the time of the 1990 census. The 80-km (50-mi) distance defines the radius of potential radiological effects for calculations of radiation dose to the general population. Table M-2 shows similar data for projected populations in 2015. As discussed above, minority populations residing in potentially affected areas in 1990 were adopted as a baseline. Populations in 2015 were then projected from the baseline data under the assumption that percentage changes in the majority and minority populations residing in the affected areas will be identical to those projected for State populations. The Census Bureau estimates that the national minority percentage will increase from approximately 24 percent in 1990 to nearly 34 percent by 2015 (Census 1996). Percentage minority populations surrounding all three of the proposed reactor sites were less than the national minority percentage in 1990. The projected minority

populations residing within 80 km (50 mi) of the Catawba and McGuire reactor sites are expected to remain below the national percentage in 2015. Minority populations surrounding the North Anna site are projected to be somewhat larger than the national average (36 percent versus 34 percent) in 2015, as shown in Table M-2. In Tables M-1 and M-2, the sum of percentages of the different populations may total slightly more or less than 100 percent due to roundoff.

Table M-3 illustrates the uncertainties in the population estimates for the year 2015 due to the partial inclusion of block groups within the boundaries of potentially affected areas. Column 2 of the table lists the number of block groups that are partly within the circle of 80-km (50-mi) radius centered at the various facilities. Column 3 shows the number of block groups that lie completely within the circle. Potentially affected areas surrounding all three of the proposed reactor sites include two States. Columns 2 and 3 show the number of partial or total inclusions for the affected States. Column 4 of the table, denoted as "T/P," shows the number of totally included block groups divided by the number of partially included block groups. In order to minimize the uncertainties in the population estimate, it is desirable that this ratio be as large as possible. Column 5 shows upper bounds for the estimates of the total population listed in column 6. As discussed above, upper bounds were obtained by including the total population of all block groups that lie at least partially within the affected area. Lower bounds for the estimate of total population shown in column 7 were obtained by including only the populations of totally included block groups. Analogous statements apply to columns 8 through 10.

As would be expected from the value of T/P shown in column 4, uncertainties in the total population estimate for the McGuire site were the smallest among the three proposed reactor sites (+3.7 percent and -2.4 percent), as were the uncertainties in the estimate of the minority population at risk near the Catawba site (+5.7 percent and -3.3 percent). Uncertainties in the population estimates for the North Anna site were the largest among the three sites (+6.5 percent and -4.5 percent for total population; +5.9 percent and -4.2 percent for minority population). None of the uncertainties shown in Table M-3 are large enough to noticeably affect the conclusions regarding radiological health effects or environmental justice.

The percentage of low-income persons living within 80 km (50 mi) of the proposed reactor sites was also projected to 2015. In 1990, the percentage of low-income persons (i.e., those with reported incomes below the poverty threshold) residing in the contiguous United States was 13.1 percent. The percentage of low-income persons living within 80 km (50 mi) of the proposed reactor sites was lower than the national average in every case. Around the Catawba site, the percentage of low-income persons living within 80 km (50 mi), in 1990, was 10.5 percent. At the McGuire site, the percentage was 9.8 percent, and around the North Anna site, the percentage was 6.9 percent.

The estimated number of low-income persons living within 80 km (50 mi) of the Catawba site in 2015 is 157,477 or 7.0 percent of the projected population. The estimated number of low-income persons living within 80 km (50 mi) of the McGuire site in 2015 is 171,182 or 6.6 percent of the projected population. The estimated number of low-income persons living within 80 km (50 mi) of the North Anna site in 2015 is 110,531 or 5.4 percent of the projected population. Based on the fact that all of these areas had low-income percentages lower than the national average in 1990 and that the percentages are projected to decline from the 1990 levels, it is estimated that the percentage of low-income persons living within 80 km (50 mi) of the proposed reactor sites will remain lower than the national average for all three sites.

Table M-1. Racial and Ethnic Composition of Minority Populations Residing Within 80 km of Candidate Sites in 1990

Reactor Site	Total Pop.	Minority Pop.	Percent Minority Pop.	Asian or Pacific Islander Pop.	Percent Asian or Pacific Islander Pop.	Black Pop.	Percent Black Pop	Hispanic Pop.	Percent Hispanic Pop.	Native American Pop.	Percent Native American Pop.	Other Race	Percent Other Race Pop.	White Pop.	Percent White Pop.
Catawba	1,519,392	315,089	20.7	10,942	0.7	288,382	19.0	10,666	0.7	5,098	0.3	442	0.0	1,203,861	79.2
McGuire	1,738,966	305,717	17.6	12,007	0.7	275,789	15.9	12,094	0.7	5,828	0.3	479	0.0	1,432,770	82.4
North Anna	1,286,156	281,652	21.9	18,783	1.5	241,619	18.8	17,550	1.4	3,686	0.3	947	0.1	1,003,557	78.0

Table M-2. Projected Racial and Ethnic Composition of Minority Populations Residing Within 80 km of Candidate Sites in 2015

Reactor Site	Total Pop.	Minority Pop.	Percent Minority Pop.	Asian or Pacific Islander Pop.	Percent Asian or Pacific Islander Pop.	Black Pop.	Percent Black Pop	Hispanic Pop.	Percent Hispanic Pop.	Native American Pop.	Percent Native American Pop.	Other Race	Percent Other Race Pop.	White Pop.	Percent White Pop.
Catawba	2,265,495	597,376	26.4	37,756	1.7	507,810	22.4	40,504	1.8	10,700	0.5	606	0.0	1,668,119	73.6
McGuire	2,575,369	620,701	24.1	43,333	1.7	517,577	20.1	46,486	1.8	12,635	0.5	670	0.0	1,954,668	75.9
North Anna	2,042,200	731,773	35.8	106,086	5.2	508,719	24.9	111,992	5.5	4,976	0.2	1,165	0.1	1,309,262	64.1

Table M-3. Uncertainties in Estimates of Total and Minority Populations for the Year 2015

Reactor Site	No. of Partially Included Block Groups	No. of Fully Included Block Groups	T/P	Upper Bound for Total Population	Estimate of Total Population	Lower Bound for Total Population	Upper Bound for Minority Population	Estimate of Minority Population	Lower Bound for Minority Population
Catawba	54 (NC) 52 (SC)	851 (NC) 314 (SC)	11.0	2,395,224	2,265,495	2,191,319	627,435	597,376	579,620
McGuire	64 (NC) 24 (SC)	1,190 (NC) 129 (SC)	15.0	2,672,795	2,575,369	2,513,292	636,842	620,701	611,521
North Anna	84 (VA) 10 (MD)	710 (VA) 5 (MD)	7.6	2,175,504	2,042,200	1,949,928	775,277	731,773	700,983

M.5.2 Environmental Effects on Minority and Low-Income Populations Residing Near Proposed Reactor Sites

The analysis of environmental effects on populations residing within 80 km (50 mi) of proposed reactor sites is presented in Chapter 4 of the SPD EIS. This analysis shows that no radiological fatalities are likely to result from implementation of the proposed action or alternatives. Radiological risks to the public are small regardless of the racial and ethnic composition of the population, and regardless of the economic status of individuals comprising the population. Nonradiological risks to the general population are also small regardless of the racial and ethnic composition or economic status of the population. Thus, disproportionately high and adverse impacts on minority and low-income populations residing near the various facilities are not likely to result from implementation of the proposed action or alternatives.

M.6 REFERENCES

Campbell, Paul, 1996, *Population Projections: 1995-2025*, U. S. Department of Commerce, Bureau of the Census, October.

Census, 1996, *Resident Population of the United States: Middle Series Projections, 2015—2030, by Sex, Race, and Hispanic Origin, with Median Age*, U.S. Bureau of the Census, March.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice, Guidance Under the National Environmental Policy Act*, Executive Office of the President, Washington, DC, December 10.

DOC (U. S. Department of Commerce), 1992, *Census of Population and Housing, 1990: Summary Tape File 3 on CD-ROM*, Bureau of the Census, May.